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United States Department of the Interior
Fish and Wildlife Service

Fishery Leaflet 146

Washington 25, D. C. October 1945

PRELIMINARY REPORT ON THE USE OF DDT AS AN INSECTICIDE IN THE FISHERY INDUSTRIES

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The current interest in DDT for the control of flies and other insect pests was anticipated by the Division of Commercial Fisheries of the U. S. Fish and Wildlife Service. As soon as this insecticide was made available to civilians for experimental use, a research program was initiated to determine how it could be used most effectively in the fishery industries. Although the research is still in progress, and much is still not known concerning its use, interest in the insecticide has reached a point where it seems desirable to make a preliminary report on its use in the fishery industries.

One of the first large scale applications of DDT for civilian use recently was carried out in the fishery establishments at Crisfield, Maryland. This experiment was conducted by the Fish and Wildlife Service in cooperation with the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture. The results were so successful that there seems to be little doubt regarding the effectiveness of DDT in reducing the house-fly populations in fish-processing plants. The reduction of the number of flies inside the plants was from 95 to 99 percent, and the fly population has not increased in these plants since the initial treatment. By the use of supplementary DDT treatments outside of the fish houses and throughout the community, it has been possible to reduce the number of flies in the entire city. The Crisfield experiment will be described in detail in a later report.

Types of DDT Treatment

Two types of controlled DDT application have been used successfully thus far. The first consists of applying DDT preparations to the walls, ceilings, screens, etc. with the object of obtaining an enduring insecticidal effect. This type of application is known as a residual spray. A second type consists of filling the air within an enclosed space with a fine-particle mist of insecticide. This is known as space spray and its purpose is to kill any adult flying insects which may be present at the time of spraying. Space spraying is not effective for more than several hours under ordinary circumstances and does not prevent flies and other insects from entering buildings.

Residual spraying can be accomplished best with a pressure type of sprayer although if nothing else is available, the ordinary type of household sprayer can be employed. The common pressure garden sprayer can be used successfully but such sprayers have several defects. The construction is usually insufficiently rugged for continued use around fishery plants. The rubber washers and hose are not chemically resistant and disintegrate rapidly with certain DDT preparations. Trouble has also been experienced with clogging of the nozzle, especially with particles of rubber. The most satisfactory sprayer is a decontamination device designed for Army use. This is built for hard use and is equipped with chemically resistant rubber fittings. A variety of nozzles are available for this device which make it more versatile than the garden sprayer. Where residual applications are made with DDT dust, the ordinary garden duster or "puff gun" is satisfactory.

Space spraying is accomplished with either the aerosol bomb or with a special hand sprayer developed at the laboratory of the Bureau of Entomology and Plant Quarantine at Orlando, Florida. Although this latter device is not yet commercially available, it offers an advantage over the bomb in that directional control of the spray may be obtained to a limited degree, and less insecticide is usually employed because of the high concentration of insecticidal ingredients in the spray. In fishery establishments these advantages are desirable because contamination of exposed food products is less likely. At present aerosol bombs are available to civilians at a cost of about four dollars per one pound bomb. The hand sprayer, when available, will probably be more economical.

Formulas for Sprays

The basic constituent of all DDT sprays is technical DDT. This powder is soluble in oils and various other organic solvents. Special DDT preparations are also available which can be used in powder form or as water suspensions. When used as a solution in oil, an emulsion in water, or suspension in water, the usual concentration employed is five percent (5%). As a powder for roach control, a ten percent (10%) concentration of DDT in an inert base is employed. The aerosol bomb contains three percent (3%) DDT in a special solvent. The concentrated spray used in the hand applicator contains twenty percent (20%) DDT. Listed below are formulas for the various DDT preparations.

Residual Sprays

1. Solutions in kerosene or other oils.

DDT (technical)	7 ounces
Solvent	1 gallon

In practice, two pounds of dry DDT are dissolved in five gallons of solvent. Such solutions are not easily prepared. It is best first to prepare a uniform sludge of the DDT in a small amount of the oil. This is then added to the remainder of the solvent with agitation. Permitting the mixture to stand at room temperature for several hours, followed by agitation or stirring, usually yields a satisfactory product.

2. DDT concentrate for water emulsion.

DDT (technical)	25%
Emulsifier (triton-X-100)	10%
Solvent (xylene)	65%

The DDT and emulsifier are readily soluble in xylene.

To make the water emulsion, add one part of concentrate to four parts of water for a five percent DDT preparation. Seawater as well as fresh water may be used. The emulsion is milky white and is stable for several hours. If left standing for any length of time, it should be stirred prior to use. Although the concentrate is inflammable, there is no fire hazard with the emulsion.

3. Dispersible DDT for water suspension.

A mixture containing fifty percent (50%) DDT and a wetting agent is available on the market for making water suspensions of insecticide. Four pounds of this powder is mixed with five gallons of water to make a five percent suspension of DDT. A better product containing ninety percent (90%) DDT has also been employed but is not yet available commercially. Ordinary technical DDT can not be used for making suspensions.

Suspensions made from these dispersible powders are not as stable as the emulsion and require almost continual agitation during spraying. However, they have the advantage of being free of odor and fire hazard.

4. DDT dusting powder.

This product contains ten percent DDT in talc or some other inert dry base. It is used as a dust in the form in which it is purchased. It can not be employed as an emulsion or suspension.

Space Sprays

1. Aerosol Bomb.

DDT (technical)	3%
Pyrethrum	2%
APS-202 (solvent)	15%
Freon	80%

These bombs are filled at the factory and are operated according to directions printed on them. Some types are refillable at the factory, whereas others must be discarded when the contents are exhausted.

2. Concentrated spray.

DDT (technical)	20%
APS-202	40%
Pyrethrum	15%
Kerosene	25%

This mixture is used in the special hand sprayer mentioned earlier in this report.

Preparation of Fishery Establishments for DDT Treatment

The success of an application of DDT in a fishery establishment is dependent upon the care with which the plant is prepared for spraying. Failures which have been reported are due largely to a disregard of basic considerations. The following instructions should be followed carefully if the insecticidal treatment is to be effective.

1. All fly-breeding situations in the plant and its immediate vicinity must be eliminated. Look for fly emergence from refuse and garbage dumps, offal and fishery wastes under docks or buildings, latrines, etc. Complete eradication of sources of flies will yield a marked reduction in their number without the use of DDT and lead to a more efficient use of the insecticide. If flies emerge faster than DDT can kill them, an extravagant waste of DDT results.

2. Window and door screens should be kept in good repair and kept in use. DDT does not keep flies or other insects out, it merely kills them slowly when they make contact with it. Open, unscreened windows serve as invitations for insects to enter; they do not act as escapes for those already inside the plant. Failure to use screens properly may mean failure of the DDT application.

3. The plant must be clean before DDT can be used effectively. Filth on the walls, screens, etc. will tend to reduce the insecticidal effectiveness of DDT.

4. All surfaces which are to be sprayed should be dry before applying DDT. Condensation moisture on the walls or ceiling or hosing down these surfaces just prior to spraying may prevent the proper distribution of the insecticide and will interfere with its adhesiveness.

5. To protect the consumer from any possible undesirable effects of DDT, cover all exposed food, utensils, etc. before spraying. This can be accomplished by adequately covering such material with heavy wrapping paper. A better method is to apply the DDT treatment after the plant has closed and all food and utensils have been removed.

Type of Treatment to Use

Where flies are present only in small numbers (10-25 flies per room) a fly swatter is probably as efficient as and less expensive than DDT. Where flies are a continual nuisance, however, or are present in large numbers, a residual spray is probably the most effective. This type of treatment also may be best for roach control although more work must be done before final recommendations can be made regarding these pests. In retail fish stores or in certain special situations, such as the holds of fishing vessels, the space spray may be the treatment of choice. In the case of the former, a combination of the two methods can be used effectively.

In applying a residual treatment in places where food is present, even though it may be covered, it is well to avoid the use of oil solutions since these may

impart undesirable flavors or odors. The ideal material for this situation is the water suspension. The water emulsion can also be used. Although xylene possesses some odor, it volatilizes rapidly and if food is properly covered no odorous contamination of it should result from the use of the emulsion.

Five percent DDT as a solution, emulsion or suspension is usually applied at a rate of one gallon per 1,000 square feet. This yields adequate coverage for residual treatment. In the case of the aerosol bomb, the insecticide is released for five (5) seconds per 1,000 cubic feet. If there are drafts or large open spaces, this time should be doubled. Using the concentrated spray in the hand applicator requires about ten (10) strokes per 1,000 cubic feet. As in the case of the bomb, this should be increased where conditions warrant it.

Space spraying is an extremely simple procedure. After calculating the volume of space to be treated, it is only necessary to open the valve on the bomb and permit the insecticide to escape for the proper length of time. It aids the distribution of the aerosol to walk about the room while spraying but this is not necessary unless the room is long and narrow or contains pockets into which the spray may not penetrate.

In residual spraying, walls and ceilings should be adequately covered with the DDT preparation. In addition all light cords, wires, pipes, etc. where flies are known to rest should be treated. Areas showing large numbers of fly specks should be given particular attention. Screens on windows and doors should be sprayed on both sides so that any flies which alight upon them will be in contact with DDT. Door and window jambs also should be treated thoroughly. To conserve insecticide, screens can be painted with the DDT mixture, using a brush instead of a sprayer.

Supplementary spraying can be done with a kerosene solution. This is cheaper than the emulsion and is satisfactory wherever food is not exposed. Sidewalks, chum platforms, loading decks, etc. should be thoroughly sprayed. All latrines should be sprayed inside and out and care should be taken to thoroughly treat the under surface of the seats. Garbage cans, waste receptacles, wheel barrows, etc. should also be treated. With the exception of the situations listed below, treat any area where flies are observed to congregate.

Until further information is available, care should be taken to avoid spraying the following:

1. Piles of shells from oysters, clams, scallops, etc. unless it is known with certainty that the shells are to be used for fertilizer or lime and not for cultch or chicken feed.

2. Fish offal, crab scrap or other fishery waste which may be used subsequently as animal feed.

3. Any containers, utensils or conveyances used for handling fresh or processed fish.

4. Work benches, packing tables or other places where fish may come into direct contact with a DDT treated surface.

5. Freight cars, trucks, boats, etc. where the disposition or handling of fish can not be controlled at all times.

These precautions may not be necessary when space spraying is used but most of the above situations are not suitable for aerosol treatments. The exception is the case of vehicles where the aerosol bomb may be used very effectively.

What to Expect from DDT

Residual treatments with DDT are effective for a long time. The exact period of insecticidal activity depends upon a number of conditions which can not be discussed in this report. The lethal effect is not rapid, usually requiring from twenty minutes to several hours, but eventually every fly which comes into contact with DDT will die. In the case of the aerosol or concentrated spray, the effect is immediate because of the combined action of DDT and pyrethrum. The latter ingredient makes for a rapid "knock-down" of the insect; the DDT insures its death. DDT is not a substitute for screens, cleanliness or sanitation. Without careful attention to these factors DDT is of little value. When used as an additional weapon against flies the results are phenomenal. It is in the best interests of the fishery industries to use this new insecticide wisely.

List of Manufacturers of DDT

The list of concerns mentioned, and their products, are given for your information and no guarantee of reliability of the firms or endorsement of their individual products is inferred. No attempt has been made to make the list fully complete and no discrimination is intended or implied against firms whose names or products are not listed.

Geigy Company
89-91 Barclay St.
New York 8, New York

Cincinnati Chemical Works
Norwood, Ohio

Grasselli Chemicals Division
E. I. Du Pont de Nemours & Co., Inc.
Wilmington, Delaware

Sherwin-Williams
295 Madison Avenue
New York, New York

Hercules Powder Co., Inc.
900 Market Street
Wilmington, Delaware

Monsanto Chemical Company
2nd and Lafayette Street
St. Louis 4, Missouri

General Chemical Company
40 Rector Street
New York, New York

Elko Chemical Works
60 E. 42nd Street
New York, New York

Westvace Chlorine Products
405 Lexington Avenue
New York, New York

Merck and Company
Rahway, New Jersey

Pennsylvania Salt Mfg. Co.
Widner Bldg.
Philadelphia 7, Pa.

Naugatuck Chemical Company
Naugatuck, Conn.

Michigan Chemical Co.
St. Louis, Michigan

Baker & Company
Phillipsburg, New Jersey

Rohn & Hess Mfg. Co.
Philadelphia, Pa.

American Home Products Company
Marietta, Ohio

Pharma Chemicals Corp.
175 Fifth Avenue
New York, New York

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